Capture Your Collections

A Guide for Managers Planning and Implementing Digitization Projects

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Foreword

For close to 30 years, the Canadian Heritage Information Network (CHIN) has sought to ensure that its member museums, and their international counterparts, benefit fully from emerging technologies. As we enter the 21st century, cultural and heritage institutions are becoming increasingly aware of how vital the Internet is for reaching and engaging today's audiences. However, to fully benefit from the medium's promise, organizations must be capable of offering rich content. This obviously includes high-quality digital images, which have also proven to be tremendously useful in the management of collections and in exploring commercial markets for museum intellectual property. This publication is designed to guide museum managers through the planning and implementation of a digitization project. It covers issues such as non-digital images, new photography, the exposure and care of objects, copyright, storage and much more. These guidelines serve as a complement to CHIN's Online Training series — which also includes the Capture Your Collection online course — and CHIN's Intellectual Property Management Series. For more information on CHIN's products and services for museum and conservation professionals, please visit our Web site at www.chin.gc.ca.

Introduction

What are digital images?

The term 'digitization' refers to creating a digital object (i.e. one existing inside a computer) from a physical object.[1]

A digital image is composed of pixels (picture elements), similar to dots on a newspaper photograph or grains on a photographic print, which are arranged according to a predefined ratio of columns and rows. Each pixel represents a portion of the image in a particular color, or shade of grey.[2] A digital image can be edited, manipulated, e-mailed across the world, deleted, or copied and inserted into other files, World Wide Web pages and publications.[3]

Why digitize?

CHIN's 1999 "Information Technology in Canadian Museums" survey indicated that 49.1 percent of respondents are currently digitizing or plan to digitize images from their collections in the next year. Digital images are used for printing, documentation, research and online publishing, most commonly in the service of collections management and preparing catalogues, and promoting exhibits or other events.

Why has digitization become so commonplace? One of the main virtues of digital imaging is its ability to make collections vastly more accessible. Digital technology helps achieve institutional goals, whether highlighting particular aspects of local history or reaching a national or international audience. Collections that were once too remote to be viewed are now accessible; objects that were once too fragile to be handled or exhibited can now be seen by broad audiences. By making it possible to bring together diverse materials or collections from scattered locations for comparison and research,

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[1] Smith, Steve, and Mark Minarelli. *Digitisation of Collections: Consultancy Report*. http://www.unitedfocus.com.au, p. 8.

[2] Besser, Howard, and Jennifer Trant. *Introduction to Imaging: Issues in Constructing an Image Database*. http://www.getty.edu/gri/standard/introimages/ Glossary.

[3] Smith and Minarelli, p. 8.

digital technology can be a powerful teaching aid, especially when institutions work together to create a critical mass of complementary material.

Digitization can also aid collections management by increasing all staff members' awareness of the content of collections, especially if images are linked to your collections management system and networked throughout your museum. Sometimes merely selecting objects for digitization gives staff an additional opportunity to establish and record the condition of artifacts. Digitization also provides an incentive to improve documentation, especially if companion records are to be made public along with the digitized images: The need for standards and enhanced information soon becomes obvious. The funding cuts of the last decade and the need to generate new revenues has caused public programming to overshadow collections management activities. An indirect benefit of digitization is that sometimes it is the only way to attract new funding to this important activity.

Digitized images are used in a wide range of outreach activities, including Web sites, promotional material, new products for the museum gift shop, and so on. Digitization enhances preservation and conservation strategies, since once digitization has occurred the handling of fragile originals can be minimized. Digital images also play a role in outreach and public access, e.g., the production of exhibitions and the dissemination of information through virtual exhibitions, in galleries and through publications. Because digital technology makes it possible to search large numbers of records, to modify and manipulate images and text, and to bring together disparate materials in new ways, it can be considered a flexible tool useful throughout the museum. The ease of performing the tasks mentioned above is also an incentive for increased cooperation with other institutions.

Digitization projects are not cheap, but they should be viewed as a long-term investment for your institution and can yield substantial benefits. Planning the project needs to account for the time and resources necessary for the physical preparation of materials to be processed and the development of appropriate documentation to ensure intellectual control.

Energies and funding devoted to a digitization project will impact resources available for other activities. Issues to be addressed in budgeting for digitization are the redeployment of human and physical resources, staff training, acquisition and maintenance of new equipment, the preservation of digital objects, prioritizing what to digitize, and maintaining current projects. Of utmost importance is a willingness to assess results in a realistic fashion. Managers and staff may need to acquire new skills to cope with the novel and exciting challenges of the digital environment.

Although digitization is a means of preserving your collections, the nature of digital information requires special attention. Digital media can be short-lived if appropriate processes and procedures are not in place. The rapid pace of technological change means that the hardware and software required to read the digital data can become obsolete. Therefore, the digitization project must take into account the ongoing cost of migrating digital data from existing storage devices to new ones.

In light of these issues, museums must look to their own institutional mandates, their programmes and their priorities in determining how they wish to proceed with digitization. Digital technology shows great promise, but is best viewed as one tool among many. Any digitization project, whether of entire collections or specific parts of them, should reflect the organization's core mission.

Project Planning

Before an institution embarks on a digitization project, it should allocate adequate resources of time and money for at least the following:

- Assessing the institution's needs, deciding where digitization is appropriate and where it is not,
- Defining the project,
- Researching technological options,
- Choosing standards,
- Developing requirements statements,
- Planning the implementation of the project, including milestones and a timetable, and
- Monitoring, evaluating and adjusting the project as required.[4]

Future requirements should also be considered, so that rapid technological change will not limit future options. Implementing a digitization project in several stages can provide the flexibility to accommodate possible alternatives along the way. The museum should begin with a very clear idea of what digitizing the institution's collection will achieve and how it will further the institution's goals.[5]

Establishing a management policy for digital assets

Establishing a policy for managing digital assets should be part of the planning process. Just as an institution needs a collections management policy so it should have a policy on creating and managing digital assets,[6] which form a valuable 'collection' of a new kind.

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[4] Shaughnessy, Roxane. *An Approach to the Digitization of the Collection at the Museum for Textiles*. Toronto: Museum for Textiles, 1999, p. 24.

[5] Shaughnessy, *An Approach*, p. 13.

[6] Bramich, Katy, and Judith Cannon. *Capturing the Big Picture: Strategies for Image Libraries at the National Museum of Australia*. http://www.nma.gov.au/80/aboutus/products/bigpic.pdf, p. 107.

The policy should define at least the following:

- Copyright and legal policies for staff,[7]
- How digital images, once created, will be managed,
- How image content and technical information will be documented,
- Plans for safe storage, conservation and preservation of master images and surrogate images to ensure their longevity,
- Plans for migration to new formats and technologies as needed, and
- Plans for digitizing and documenting new objects.

The policy should be reviewed periodically to determine whether project plans or policies need adjusting.

Defining the audience

Before a single image is digitized, the intended users of the images, both inside and outside the institution, should be determined; furthermore, they should be involved in the development of the project, if possible.

Identifying potential internal uses will help define the institution's digitization strategies. Different members of the organization should help define their imaging needs and how digital images can meet them. Establish institutional goals for making use of digital images, and identify the departments and staff who need to participate.

The project leader should interview staff members, volunteers and others who will use museum images, asking about not only immediate uses, but future ones as well. Internally, digital images have many uses across an institution. Images may link to collections management systems in order to illustrate artifacts and collection records for loans, insurance and other collections management functions. Or they may be used to document the institution's intellectual property (IP). High-resolution images may be required for publication purposes, to illustrate newsletters, brochures and postcards. Specialty uses for high-resolution images such as detailed conservation or analysis should also be considered. For public access and outreach, images could be mounted on the Web

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[7] Bramich and Cannon, pp. 107-108.

site or a museum public access terminal, or be used in the creation of CD-ROMs or publications.

These requirements must be known at the outset, because how the images are to be used will determine their quality and the resolution required, which will later affect both the choice of scanning technology and overall system requirements.[8]

Although future use determines the choice of quality and resolution, as a general rule images digitized at the highest resolution possible serve the greatest number of purposes.[9]

Evaluating assets

A careful assessment is needed of what images the institution currently has, considering the following questions:

- What objects have already been photographed?
- Those images are in what formats?
- How are the images stored?
- What is the quality of the images?
- Are digitized images from a previous project available?
- At what resolution have the digital images been stored?

A survey of all of the photographic holdings of an institution should be carried out to determine not only what images are held in different parts of an institution but also in what formats these images are currently available. In a large institution, many departments will have images for their own use; a smaller institution may have fewer existing digital or photographic resources.

Next is an assessment of the images currently available. Digitizing already available images, such as colour transparencies, will be a less costly and time-consuming process than beginning 'from scratch'. If images from photographs or transparencies are being

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[8] Shaughnessy, *An Approach*, p. 15.

[9] Shaughnessy, *An Approach*, p. 15.

scanned or have been scanned, only good-quality images should be used.[10] Some objects will need to be rephotographed if the images on hand are in poor condition or are not good representations of the original object. Ideally only good, professionally photographed images created with a colour bar or grey scale should be digitized.

If previously created digital images are available, consider whether the quality is high enough for current needs, and whether the associated documentation is adequate. New photography will add significantly to the time and money required for a digitization project, particularly when the objects to be photographed require significant preparation time. For example, large objects such as canoes may have to be transported from storage to a suitable place to be photographed; complex objects, such as costumes, may require a great deal of preparation.[11]

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[10] Bramich and Cannon, p. 42.

[11] Gosselin, Andrée *Comment numériser vos collections? : Le Guide de planification du Réseau Info Musée*. Montréal: Société des musées québecois, 1997, p. 68.

Consider the following museum activities and their potential use of digital images[12].

MUSEUM ACTIVITIES	USE OF DIGITAL IMAGES	TYPE OF PHOTO REQUIRED	FORMAT OF DIGITAL IMAGE ON SCREEN	REPRODUCTION OR PRINTING OF DIGITAL IMAGE	QUALITY OF REPRODUCTION FOR PRINT
Collections Management	Identification of object; image in database; acquisitions committee; cultural property application preparation; loans; inventory; donor records; condition reports; permanent archives	Inventory and documentary	Small and full-screen	Collection management reports; archival and inventory reports	High, medium and low
Conservation	Research; object analysis; condition report; record of object treatment; electronic transmission for treatment consultation	Inventory and documentary	Large-format	Conservation reports; treatment requests or reports	High, medium and low
Research	General and specific research; development of exhibition concepts; structural analysis; research results	Inventory, documentary and professional	Small, full-screen and large-format	Research reports and publications; artifact lists	High, medium and low

[12] Gosselin, Tableau 1-1, Shaughnessy, *An Approach*, Table 1.

Education	General and specific research; courses, conferences, colloquia; workshops; presentations; museum kiosk; development of educational goals	Inventory, documentary and professional	Small and full-screen	Educational publications and brochures; educational multimedia products	High, medium and low
Marketing and Communications	Preparation of brochures; promotional materials, public relations materials, press kits, flyers for exhibitions; fundraising campaigns	Professional	Small and full-screen	PR materials; fundraising brochures; flyers, press kits	High, medium and low
Electronic media	Web site; multimedia products; virtual exhibitions	Documentary and professional	Small and full-screen		Medium and low
Publishing	Preparation of exhibition materials; posters; post-cards; catalogues; museum publications	Documentary and professional	Small and large format	Publications; posters; post cards	High, medium and low
Library	General and specific research; books	Documentary	Small and full-screen	Research reports; reports on collection	Medium and low
Bookstore	CD-ROMs; posters; post-cards; books	Documentary and professional	Full-screen and large-format	Promotional material; catalogue	High and medium

Appropriate information (meta-data) relating to the object in the image, technical capture information, and provenance must be provided or created at the same time as the images are produced (see Standards and Guidelines to Consider for more information).[13] These documentation procedures will require significant amounts of staff time, but are crucial to the long-term success of an imaging project and the future management and repurposing of the digital assets created in the project.

Other important aspects of an evaluation of assets are the following:

- Consider the quality of documentation available for each image,
- Ensure that the institution has copyright to both the object and the photograph,
- Survey current equipment and software,
- Consider needs for physical space (both disk storage and physical space for staff and equipment), and
- Examine existing staff resources to help define needs.

Understanding the importance of planning

> *If we are to use digitization as a tool to provide worthwhile, enduring access to some of our most treasured cultural and historical resources, then we necessarily must take time at the outset to become informed, to establish guidelines, and to proceed in rational, measured steps to assure that such reformatting of visual matter is accomplished as well and as cost-effectively as possible.*[14]

Once the museum's current image assets are determined, the scope of the project must be defined.

Most institutions take a 'project' approach to digitization, while others systematically digitize all or very large parts of their collections.[15] Whether the project aims to digitize all or only part of the collection, before proceeding a plan is needed that outlines what will be digitized and in what order.

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[13] Columbia University Digital Library Projects. *Selection Criteria for Digital Imaging Projects.* http://www.columbia.edu/cu/libraries/digital/criteria.htm.

[14] Ester, Michael. *Digital Image Collections: Issues and Practice.* Washington, DC: Commission on Preservation and Access, 1996, Preface.

[15] Bramich and Cannon, p. 21.

Successful digitization projects require sufficient resources, including the following:

- Trained personnel,
- Digitization technology and equipment (hardware and software),
- Physical space sufficient for the process,
- Funding.

Consider the following issues[16, 17]:

- Does the material have enough intrinsic value to warrant digitization?
- Will digitization significantly enhance access or increase use by an identifiable constituency? (Digitization increases visibility for the many objects museums are unable to display.)
- What institutional or project goals might be met by digitizing? (internal, institutional process or external visibility)
- What are the costs/benefits of digitizing an entire collection vs. digitizing images for which there is a specific need?
- Does a product already exist that meets the identified needs?
- Are rights and permissions for electronic distribution secured or securable?
- Does current technology yield images of high enough quality to meet the stated requirements and uses?
- Does technology allow digital capture from a photo intermediate? Will the project need to start 'from scratch' with either a new photo or digital image capture?
- Does the institution now have expertise in the necessary technology?
- Will all or part of the collection be digitized to promote effective collection management practices or public access to collections information?
- How will objects to be digitized be chosen?
- Will ongoing activities (i.e., exhibit development) help determine what objects are digitized?
- Will digitization take place in-house or be contracted out?
- What quality of digitization is required? Is the cost affordable? What compromises between cost and quality might be needed?

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[16] Smith and Minarelli, p. 41

[17] Hazen, Dan, Jeffery Horrell, and Jan Merrill-Oldham. *Selecting Research Collections for Digitization.* http://www.clir.org/pubs/reports/hazen/pub74.html.

- How will digital objects be stored and categorized? What information (meta-data) about each one will be included?
- How will digital objects be searched for and located once they have been created? How will they be linked to the original object?
- How will the digital assets so created be managed on an ongoing basis?

Developing the project plan

Institutional goals and requirements will determine how the project should proceed. Project members should try to think of all the ways images can be used and reused to make the broadest possible use of the material.[18]

Some questions to consider when determining requirements are as follows:

- What will the images be used for?
- How will the images be made available?
- Will digital images replace traditional photographic images?
- What standards will be used?

N.B. Decisions made while planning the project affect the entire process. For example, decisions about the resolution of scanned images, or the amount of documentation, can dictate how the images themselves are used.[19] The project will not be successful if images must be rescanned in a few years because of poor initial choices of technology or documentation.

The following broadly defined tasks or phases should be part of the overall plan:

Planning

- Define the purpose, goals, scale and scope of the project,
- Survey current images to assess the strengths of the collection,
- Evaluate current documentation and standards used to create it,

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[18] National Initiative for a Networked Cultural Heritage. "Evaluative Criteria." *Guide to Good Practice in the Digital Representation and Management of Cultural Heritage Materials* http://www.ninch.org/PROJECTS/practice/criteria-1.html.

[19] Grout, Catherine, Phill Purdy, and Janine Rymer. *Creating Digital Resources for the Visual Arts: Standards and Good Practice.* http://vads.ahds.ac.uk/guides/creating_guide/sect51.html, Section 5.1: Project Management.

- Analyze technical standards,
- Inventory available equipment,
- Set priorities,
- Develop and document a plan, including workflow strategy,
- Identify staffing needs,
- Assess costs and implications of doing projects in-house vs. contracting out the work,
- Secure funding,
- Select/hire/recruit, and train staff to form a working group or project team.

Data preparation

- Select data documentation standards, and technical formats and standards,
- Establish copyright,
- Determine and record information about copyright restrictions and permissions, conserving/preserving and tracking movement of the digital objects,
- Properly document photographs of collection material, whether they are being contracted out or digitized in-house,
- Where images exist, ensure that the image and its documentation are stored together.

Image capture

- Purchase and set up equipment,
- Take high-quality photographs of objects,
- Where photographs already exist, scan the photographs of the objects (or send them to an outside source, with explicit instructions about requirements),
- Store high-resolution images securely,
- Perform quality control and evaluation.

Storage and delivery

- Store the photographs of collection materials properly,
- Store archival-quality digital images on a server,
- Store any CDs produced securely in appropriate environmental conditions,
- Link digital images to the collection management database,
- Perform internal evaluation,
- Make images available to a variety of online users,

- Maintain and refresh data,
- Ensure off-site storage of copies for security purposes.[20]

Establish a realistic timeframe for the project, realizing that the time allocated to each stage will depend upon the size of the collection, the staff available to work on the project, the preparation time required and the current state of the collections management system and documentation, as well as on whether it is decided to digitize all or only parts of the collection.

Prioritizing the work

Even if the long-term goal is to digitize the entire collection, the project will probably be done over time in accordance with financial and staff constraints.[21] The work to be carried out should be prioritized according to the project plan previously defined. Generally priority should be given to the following:

- Images for which there is copyright clearance of both the object and the image,
- Iconic images significantly associated with the institution,
- Images for which there is good documentation,
- Objects used in exhibits, current or upcoming,
- Images of the museum that could be developed into a virtual tour or promotional publications,
- New objects,
- Well-formed collections of particular significance or special public and/or educational appeal,
- Images following a particular theme or subject area,
- Natural groupings in the collection.[22]

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[20] Bramich and Cannon, p. 38.

[21] Canadian Heritage Information Network. *Training Workshop in Digitization Methods*, p. 8.

[22] Bramich and Cannon, pp. 34, 37.

Documenting the plan

Documenting the plan and process is important! A project plan normally consists of a time line, indicating the start and end dates for the main activities as well as milestones or major deliverables. It may also identify staff members or departments responsible for each activity.[23] This documentation is particularly valuable in laying out a 'staged' approach, and ensuring continuity should staff members responsible for part of the process leave the institution.

Determining a long-term strategy is key. The plan should include periods for assessment, to determine whether strategies need to change. A well-planned project makes the best use of resources and yields successful results.[24]

Defining the resources required

A digitization project will have an impact on budget, staffing, workload, available space and equipment. Staff with the necessary skills will need to be hired or trained (at the least, to document and manipulate the images if the work is contracted out). If existing staff is trained, consider how the ongoing workload will be affected. Think about how the digitization project will affect the institution's overall plans and whether the institution has other major plans that will need to use these same resources heavily.

Skills required

Skills required in a digitization project[25] include the following:

Administration

- Project management,
- Project leadership,

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[23] Grout, Purdy and Rymer, Section 5.1.

[24] Wallace, Greg. *Introduction to Image Digitisation for Museums.* Western Australian Museum, 1999.

[25] Adapted from Smith and Minarelli, p. 41, and Kenney, Anne R., and Oya Y. Rieger, Research Libraries Group, *Managing Digital Imaging Projects Course*, Mountain View, California, 1999.

- Supervision of production.

Collections management/subject specialists

- Knowledge of cultural material documentation practices, including descriptive information about objects as well as data about the images,
- Cataloguing and documenting digital objects,
- Familiarity with requirements for reproducing cultural materials.

Preparation

- Preparation of detailed instructions for digitization — whether the work is done in-house or contracted out,
- Preparing objects for digitization,
- Preservation, archiving and disposal of digital objects.

Systems support[26]

- Technical expertise in operating digitization hardware and software,
- Experience with image scanning, processing and quality control.

Reproduction services

- Monitoring digitization procedures and performing quality reviews.[27, 28, 29, 30]

In small organizations, many of these tasks are performed by the same people, some of whom may be volunteers. In other cases, many of these functions may be contracted out.

Establishing responsibility

Only if management's commitment to digitization projects is well established will any project that is undertaken be a success.

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[26] Ester, p. 20.

[27] Smith and Minarelli, p. 41.

[28] Kenney and Rieger, Research Libraries Group. *Managing Digital Imaging Projects Course*. Mountain View, CA: RLG, 1999.

[29] Smith, Steven. *Digitising Collections: The Redefining of Museums*. A paper delivered at Museums and the Web '98, Toronto, Canada 1998. http://www.unitedfocus.com.au/internet.html, p. 15.

[30] Ester, p. 19.

The capabilities of current staff and their interest in learning new technologies must be realistically assessed. The person serving as project leader can survey the various parts of the institution, ensuring that staff members understand the goals of the project. Tasks for departments and managers will change as new tools are obtained and new priorities set. Rather than forcing staff members to take on new tasks that they had not anticipated assuming, it is much better to stress the positive opportunities for professional development that the digitization project makes available.[31]

When responsibility for these tasks has been established, it is crucial to make sure that all staff understand that this responsibility has been assigned. Good staff communication is one key to a successful project.

Securing preservation by means of proper storage

Digitization serves to preserve original materials, since once one has a high-quality digital image from which other image formats can be derived, it is not necessary to keep exposing objects to handling and light.

However, high-resolution digital assets have preservation and storage needs as well. If plans are not made to preserve the image collection, although it may still be possible to retrieve the images in the future, doing so may become costly if the hardware or software used to store and retrieve them become obsolete.

Digital images require considerable storage space that costs money. This should be built into the project budget. Even if the principal aim is to add images to the collections management system at low-resolution, high-resolution archival copies of the images will need to be kept, requiring storage space separate from the working collections management system. These archival copies should be stored in a fixed medium such as CD-ROM, Digital Versatile Discs (DVD), tape backup, or related device.[32] However, although these storage mechanisms seem expensive, they protect the investment in the

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[31] Bramich and Cannon, Section 7.2.3.

[32] CHIN, Training Workshop in Digitization Methods, p. 9.

digitization project. A prioritized plan is needed, with built-in review periods to assess potential changes to technology and storage media.

Ensuring access

Technology changes quickly. The plan for managing digital images must allow for staff to keep abreast of changing technologies in order not to get left with images in formats that can't be used because the hardware or software is out of date. There are two recommended strategies for avoiding obsolescence: refreshing and migrating data.

- 'Refreshing' is simply copying digital files from one storage device to another of the same type (e.g., creating a duplicate CD-ROM). This method is viable only when the digital files are in a non-proprietary format and independent of hardware and software. Hardware and software will still be required to read non-proprietary formats. If the files are in a proprietary format, problems may arise when refreshing, as the specifications of the file format may have changed. In such cases, it may be difficult to access the files.
- 'Migrated' data is changed or converted into newer (non-proprietary) standard formats, and transferred onto a newer type of storage media.[33]

Both of these strategies protect valuable data and the investment in it but do entail some cost in staff time and equipment.

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[33] Technical Advisory Service for Images (TASI). "Digital Preservation". *Creating Digital Image Archives – Overview and content programme.* http://www.tasi.ac.uk/building/dig_pres1.html.

Legal Issues Related to Digitization

Copyright issues associated with digitizing images

The protection of museum copyright and the copyright of artists/creators for which museums may be responsible is of paramount importance when digitizing images. With current technologies, digitized images can not only be made available and accessed via the Internet, but also reproduced quickly and with astonishing clarity; more than ever, therefore, copyright protection is an issue. Some of the issues to consider are outlined below.

Appropriate copyright clearances

1. **When the underlying work is still protected by copyright:** Before photographing and digitizing an image, a museum should ensure that the work being photographed and then digitized has been licensed for reproduction. Authorizations should be obtained from the artist/creator of the work that is the subject matter of the digitized photograph. If the work at issue is in the public domain, then, obviously, such authorization is no longer needed.

2. **When the photograph is still protected by copyright:** Since the digitization of an existing photograph is also a reproduction, museums should also ensure that they hold the rights to digitize the photograph. Such rights can be obtained in two ways: by ensuring that the museum holds the copyright on the photograph through an agreement with the photographer or by negotiating these rights when the photograph is later digitized. If the photograph being digitized falls into the public domain, then these authorizations are, of course, no longer needed.

3. **When the digitized image will be modified:** If, in the course of digitization, the image is somehow modified — either cropped or discoloured — rights associated with copyright, such as moral rights, may become an issue. Moral rights are held by the artist/author of the original work that is the subject matter of the image. Photographers also hold moral rights in their photographs even when copyright has

been assigned to another party. Moral rights run for the length of copyright and cannot be transferred; they can, however, be waived.

In either case, a museum should ensure that it obtains a waiver of moral rights from the artist/creator and/or photographer if the image will be manipulated so as to discolour it, crop it or modify it in any way that may prejudice the artist/creator or photographer. If the work that is the subject of the image or the photograph being digitized falls into the public domain, then the moral rights of the artist/creator or photographer are no longer an issue.

Rights management and protection technologies

For works distributed over networks, licensing to end-users, as in the software industry, alleviates some problems, but will require a moderation of demands on the part of owners, as well as an emphasis on educating end-users. Licensing, even if supported by registration, may provide too little protection for aesthetic goods that retain their value over a long period. Hence, the issue of protection of digital images has attracted considerable attention, and a number of technologies including watermarking, encryption, digital signatures and fingerprinting, have been developed and are being marketed.

As currently implemented, watermarks, signatures and fingerprints primarily have value as deterrents to misuse and copyright infringement. Encryption can achieve high levels of security, but even it cannot provide absolute protection.

New technologies aimed at protecting museum and copyright holders interests include the following:

- Encryption technology,
- Visible and invisible watermarking,
- Digital signatures as proof of ownership,
- Digital fingerprinting,
- Secure container technology, and
- Various rights management systems.

Determining the Costs of a Digitization Project

Costs to consider

Whether digitizing in-house or contracting the work out, costs based on requirements as defined are associated with any digitization project. It is important to anticipate these costs and budget for them being realistic about expectations of 'savings' from the digitization of images. Management needs to expect initial costs based on the requirements determined in the project planning phase, but should also understand that long-term benefits are great; they include enhanced collections management documentation, preservation of original objects, enhanced information on museum intellectual property, allowance for public access, increased visibility for the institution, etc.[14]

Among the various constituents of total cost for a digitization project are the following:

- Documentation,
- Material or capital costs, including equipment, hardware and software, scanning equipment and image manipulation software,
- Equipment costs for image capture, digital image storage, and maintenance of digital images,
- Human resources; either hiring new or training existing staff,
- Sufficient space and facilities for equipment and any necessary new staff,
- Transportation and handling of objects to be photographed or images going to an outside source (mainly for two-dimensional objects — costs will be higher for three-dimensional objects),
- Insurance costs related to transportation,
- Set-up time,
- Photography and/or treatment of current photographs,
- Film processing and/or scanning,
- Quality control,
- Image manipulation, i.e., adjusting images for their intended purpose,
- Ongoing maintenance.

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[14] Bramich and Cannon, p. 30

It may also be helpful to consider possibilities for cost sharing with another institution as well as pooling resources for equipment and/or staff costs.

The largest expense will not be the actual scanning or photography, but the subject expertise required for documentation, locating, reviewing and assembling source material, preparing and tracking it, and quality control.[35] On a project done in-house, these costs will take the form of training current staff, hiring new staff, and buying new equipment. It would be wise to investigate possibilities such as hiring interns or students from a community or technical college to do the image manipulation.[36] Costs for a short-term project are determined by examining the hourly salary of each member of the team involved in the project. Adding tasks to a current staff member may add 'stress', and redistribution of work should be considered.[37] A project that is contracted out will still require some staff training.

If photographs suitable for scanning are not available for all objects it is necessary to consider costs for preparation time, transportation of heavy objects, disbinding manuscripts, conservator checking of objects for damage, the photographic set-up, and the expertise required for all of these tasks.

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[35] Ester, p. 11.

[36] Shaughnessy,R oxanc. "Planning the Digitization of a Museum Collection." *Ontario Museum Association Newsletter*, September/October 1999.

[36]Gosselin, p. 99.

Digitizing images in-house vs. contracting out [38,39]

	IN-HOUSE	CONTRACTING OUT
ADVANTAGES	▪ Learn by doing and develop in-house expertise ▪ Build production capability ▪ Retain control over all aspects of imaging ▪ Some flexibility in defined requirements ▪ Security of source material	▪ Expertise and training of the digital service provider ▪ Set cost per image, prices can be negotiated based on volume which facilitates budget and project planning ▪ Lower labour costs ▪ Costs of technological obsolescence are absorbed by the digital service provider ▪ Limited risk ▪ Variety of options and services
DISADVANTAGES	▪ Larger investment ▪ No set price per image ▪ Need to set up technical infrastructure: space, digitization equipment, computers ▪ Limits on production capabilities and facilities ▪ Institution incurs costs of technological obsolescence ▪ Impact on other activities ▪ Institution pays for equipment, maintenance and personnel rather than for product ▪ Need for trained staff, training ▪ Equipment support	▪ Museum removed one step from imaging functions ▪ Possible inexperience with museum needs ▪ Quality control not on site ▪ Images will still need to be manipulated by museum staff. Random samples of the images produced should be conducted. ▪ Needs must be clearly defined in contract or there will be communications problems ▪ Transporting material — security and handling issues, especially with 3-D objects ▪ Vulnerability due to instability of digital service providers (companies in business for over two years are considered viable)

[38] Shaughnessy, *An Approach*, pp. 12-20.

[39] Kenney and Rieger, *Managing Digital Imaging Projects Course*.

If contracting out is decided upon, contract specifications for the digital service provider must be carefully defined, with a clear statement of the need for consistent results.[40]

A possible compromise between the two approaches may be to hire a professional photographer to work on-site with museum staff.

Obviously, the decision about whether to produce images in-house or by contracting out will be influenced by many factors, all part of the planning process. This is why it is important to have a realistic appraisal of the institutional situation.

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[40] Wallace. *Introduction to Image Digitization for Museums*

Standards and Guidelines to Consider

The type of data accompanying digitized materials determines how they can be searched, sorted and displayed. Museums are more capable of managing their collections when they use proper database management technologies and documentation in conjunction with digital imaging projects.

Meta-data

Meta-data may be defined as data describing a discrete data object or objects: cataloguing or indexing information created to arrange, describe and otherwise enhance access to an information object. In other words, meta-data describes information objects and gives them meaning, context and organization. It also provides content access to the content of the image and technical information about it.[41]

Content meta-data is information about the object captured in the image. If a computerized collections management system is in place, this information may be available, although recent studies have shown many museum collections management systems still lack this type of information which must be available if data sharing and public presentation are part of the project plan. CHIN's data dictionaries and other related documents on content standards are schemas that can help a museum determine what type of content meta-data it needs to record, and how to record it.

The other type of meta-data is data about the image itself; this is referred to as either technical or administrative meta-data and describes information related to the management of the image, including rights management and information about the technical processes used in creating the digital image.

It is essential to document this information and integrate strategies to avoid obsolescence to ensure that future technologies can access the images. As mentioned earlier, it is best to digitize images for which good documentation is already available.

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[41] Kenney and Rieger, *Managing Digital Imaging Projects Course*.

Recording this information will require an image catalogue or database, linked to or integrated with the existing collections management database. An image-naming convention should be developed to keep track of the images easily and to make it easy to link to collections management information.

Image standards and guidelines

No published standards or guidelines exist for determining the level of image quality required to create digital images. Of the several studies conducted to determine optimum image resolution and image file formats, most indicate that the higher the image quality, the greater the longevity of the images. Choosing a common process and format when digitizing a collection will greatly facilitate subsequent image processing.

The image capture process should produce digital images of the highest quality feasible in terms of resolution and colour depth. These master images or archival images should be stored in an offline mode or kept accessible in read-only mode, accessed only infrequently to ensure their security and to ensure that these images are kept in the original format. Only master images should be used to create subsequent surrogate images.

From the master images, surrogate images, or working copies, can be produced for a variety of purposes without having to repeat the image capture process. Digital images used for visual references in an electronic database, such as the World Wide Web, require only low-resolution formats. An even lower image resolution may be required for thumbnail access. Digital images used for high-quality printing, however, will require a substantially higher resolution image. Each type of surrogate image may require different image editing and enhancements.

To ascertain the quality required for digital imaging, it is first necessary to determine the intended uses for the images. The most common use for digital images is to make them available over the World Wide Web as low quality, thumbnail images via a collections management system. Less common, but increasing in importance, is digital reproduction or printing. These larger or more detailed reproductions require images of higher quality. Specialty uses of images for conservation work, detailed analysis of works of art, etc. require substantially higher quality images.

As mentioned earlier, the recommended rule of thumb is to capture images in the highest quality feasible, depending on the requirements previously determined, the resources available, and the size and scope of the project.

Preservation and storage standards and guidelines

The preservation and storage of digital assets must be an integral component in the overall digitization project. Long-term provisions should be made to allow for continued access to digital resources.

The resolution of the images, along with the colour depth, is a significant factor in determining image quality and image storage requirements. The higher the quality selected, the greater the storage requirements. High-quality images such as digital master images, require substantial amounts of computer storage. Surrogate images created from master images generally require much less storage space.

As the master images are generally stored offline and are accessed infrequently, offline or semi-online storage formats are generally used. CD-ROM, though a common storage medium, is limited in capacity. Digital Versatile Discs (DVD) far exceed CD-ROM in storage capacity and are becoming quite popular.

Another format used primarily for large storage requirements such as digital images is tape, although it has the drawback relatively slow access. Common formats are the Digital Audio Tape (DAT) and Digital Linear Tape (DLT). Large-capacity jukeboxes (large CD changers) are available for each of these formats, allowing access to the image archives.

Magnetic tape is relatively impermanent owing to its inherent instability, which leads to chemical deterioration and physical wear from use. Optical discs can fail because of warping, corrosion or cracking in the reflective layer, dye deterioration, or delamination.

Storage conditions are important in preserving digital images. Cooler and dryer storage conditions will extend life expectancy. The recommended conditions for storage are a temperature of between 10 and 20 degrees Centigrade, and a relative humidity of between 20 percent and 50 percent.

A backup copy of all masters should always be generated and stored off-site for security purposes.

Presentation devices

The most common presentation devices are display monitors and printers like those on personal computers. Display monitors are generally relatively low-resolution devices.

Images for printing tend to be of much higher resolution. Most colour printers are capable of printing at high-resolution and colour depth.

Transmission issues

The key factors in the transmission of digital images are the sizes of the image files and the speed of the network: Generally, the smaller the image file size, the faster the access. The primary reason for transmission of images is for display. Display monitors are generally low-resolution devices. Therefore, low-resolution surrogate images should be created for display, for both internal networks and external networks such as the World Wide Web.

Implementation

Selecting equipment and software for the project

The choice of computers for imaging projects should be based on the requirements identified and adequate power to handle high-resolution images. Digital images require considerable processing power and therefore require high-end computers. Several available computer platforms are commonly used for image capture and processing, including PC, Macintosh and UNIX. The following are some of the important factors to consider when choosing a PC equivalent imaging workstation:

CPU: Digital images make heavy demands on the central processing unit. A Pentium 400 MHz or better processor is recommended for intensive image editing.

RAM (Random Access Memory): Advanced imaging software applications normally require three times the image file size. Therefore, 30-MB image files require 90 MB of memory. More memory may be required if additional software is used simultaneously.

Disc Storage: Storage requirements are at a premium when one is working with large image files. Auxiliary storage is also recommended using high-density floppy drives such as Zip drives and a CD-ROM writer.

Display Monitor: This is a key part of the system for image processing and verification. Monitors should be as large as possible, be capable of displaying 24-bit colour (16.7 million colours), support a 72 Hz refresh rate, and have a video board with sufficient memory.

Image Software: Several types of freeware and shareware products are available on the Web. To optimize images, high-end imaging software such as Adobe PhotoShop should be used.

Preparing materials for digitization

Imaging projects that entail either traditional or digital photography of three-dimensional objects require time and skill. As mentioned earlier, large objects will need to be moved from storage to the photographic set-up; some objects (such as costumes) that may require

installation with other objects require both time and expertise.[42] Different views of the same object may be required when three-dimensional objects are photographed. All equipment, including supports and accessories, should be on hand before photographing to avoid unnecessary delays.

For the capture of two-dimensional objects, the materials should be reviewed before an imaging plan is decided upon. Some objects, such as photographs, may be scanned directly (i.e., historical photographs, not photographs of objects in the collection). Others such as medieval manuscripts may be more delicate and may require expert curatorial and conservation help before the image capture technique is decided upon.

Projects that entail scanning images already on hand will require staff to check the images for quality, to ensure that the images are not blemished, and to ensure that accession numbers are correct. This pre-scanning quality control is important in achieving the highest quality digital images possible.

Workflow, process

Staff will need to be designated for all stages of the actual digitization process. Generally, duties will fall under broad categories such as documentation, followed by preparation, which will include setting up for photography, locating and inspecting objects, and the photography itself. The actual digitization of images will include scanning, image manipulation, quality control and creating the image meta-data. Follow-up processes will include refiling and storing any new or pre-existing images, and maintaining the image preservation strategies in use at the institution.

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[42] Gosselin, p. 68.

Maintenance/Management

As mentioned, the planning process for digital imaging projects must include a policy for managing the digital assets. Typical imaging projects consist of 5,000 to 50,000 images or more; with this quantity of data, planning for managing the digital assets must become an integral part of the overall digitization project.

Quality control

Standards for the images created must be clearly defined and documented so that image quality can be evaluated, whether digitizing in-house or contracting out. The digitizing should begin with only good-quality original images. The task of assessing the quality of the digitized images should be assigned to a staff member.

Migration of data to new formats

With rapidly changing technologies, data must be transferred to new media types and formats, as necessary, in order to preserve the integrity of digital objects and to retain the ability to retrieve, display and use them.

Images should be migrated to new media and/or formats *before* the current ones deteriorate or become obsolete. Both periodic inspections of storage media to identify any deterioration and continuing review of the evolution of the technology for signs of obsolescence are needed to determine when images should be migrated.

Protecting the integrity of a digital image must be a top priority for any digital preservation strategy. The preservation of images is an example of the ways in which content, defined in terms of structure and format, poses integrity problems for digital archives. It is difficult to plan a migration strategy, as it can be very difficult to anticipate when migration is necessary, how much formatting is required, and how much the entire process will cost. The process of migration itself can degrade data quality, and this fact has implications for the overall integrity of the data.

Storage, backup and preservation

Storage must be considered for both the master images and the surrogate images (see Preservation and Storage Standards and Guidelines).

A backup strategy must be put in place for all data created, including all image formats: This includes all work in progress during image creation and image enhancement phases. Secure off-site storage is essential.

A long-term preservation strategy for the master images should be considered because the storage medium will deteriorate with time, depending on the environmental conditions of the storage area, the contents should be migrated to another storage medium of the same type or another type of storage medium as required. Also, the advancement of technology may make current storage media outdated, making it necessary to migrate to newer devices.

Summary

This document provides an overview of the key issues to consider when planning a digitization project, from the planning process through to implementing the project and maintaining your digital collections. It is intended as an introductory, reference source for senior managers.

For further, more detailed, information on digitization, please see the Canadian Heritage Information Network's online course *Capturing your Collections: Planning and Implementing Digitization Projects* at www.chin.gc.ca.

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